

Activity: Matchstick Forest

The fire triangle tries to capture the concepts underlying wildland fire behavior—a powerful, highly variable force of nature. When you're looking at a match or a candle, it looks simple. In wildlands, it usually isn't. Instead, it is complicated, intriguing, and dramatic.

In this activity, a teacher or student teams will construct and demonstrate some principles of fire behavior for the class. Matches will be used to model trees and a matrix of matches will model a forest. The class will compare fire behavior on different slopes and with different arrangements of trees.

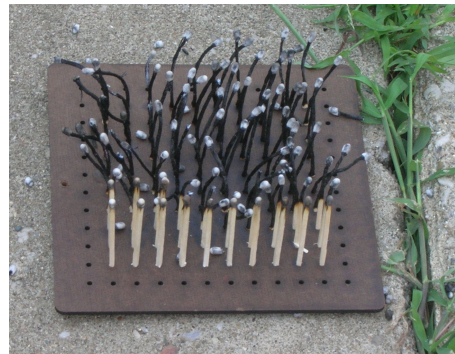
Materials Needed

Supplied in fire education kit:

- 3 masonite boards with drilled holes
- 2 screws with bolts
- Wooden matchsticks
- Safety glasses

You must supply:

- Water hose or water bottle
- Fire extinguisher
- Non-plastic trash can



Procedure

1. Explain that this activity is similar to research done by chemists and physicists. Results from research like this are used by foresters, firefighters, range managers, wildlife biologists, and ecologists.
2. Explain that different experiments will be set up for the whole class to observe.
3. Give each student team a matchstick forest model (drilled square of masonite, 1 bolts, 1 nut) and 100 matches. Ask students to insert a match in every hole of the matchstick forest model, tips pointing up.
4. If done inside, set these "matchstick forests" in burning trays on a heat-resistant surface. If you don't have laboratory facilities, one really good surface to use is a metal trash-can lid filled with sand. Let the first "forest" be level. To the second, attach a short bolt so the slope is about 20 degrees. To the third, attach the long bolt so slope is about 40 degrees. Have a spray bottle or water source and fire extinguisher nearby.
5. Explain to students that the individual matches represent trees in local forests. In this demonstration, students will observe how slope and tree density affect fire spread. Before lighting the matches, ask students for their guess (hypothesis) about how the fires will differ.
6. The person lighting the matches should put on safety glasses. Light the match tips along one edge of the flat "forest" and observe fire behavior. Then light the match tips along the top edge of the medium-slope forest and observe. Finally, light the bottom row of matches on the steep forest and observe (fig. 1). Ask for descriptions of what the students observe and interpretations in terms of the fire triangle. (Heat travels upward,

so the matches and trees uphill from a fire receive more heat than those below and are easier to ignite.)

7. Ask students to remove whatever remains of the matches from each board.

8. Ask each student team to construct a matchstick forest to solve a problem. Here are two possibilities: (1) Your matchstick forest is on a very steep slope. You can remove 25 trees from it. Find the best arrangement of 25 fewer trees to reduce the risk of fire spread. (2) You are in the timber business, and most of your land is on moderate slopes. You need to reduce the risk of fire spread on your land, but you want to raise as many trees as possible. What's the best density and arrangement for your trees?

9. Light these matchstick forests, one at a time, and discuss how well each team solved their problem.

10. Ask the students to compare the model forests used in this experiment to real forests. What are the similarities? What are the differences? How would they expect wildland fires to differ from matchstick fires?

11. Explain: Real wildland fires are much more complicated than model fires. Go over the definition of surface, crown, and ground fires. Ask students which kind of fire was modeled in their matchstick forests? (crown fire) **Note: Kentucky has more surface fires than ground or crown fires.**

15. Explain: Spot fires can be started by small fires, including slash burns, as well as large, severe fires; the spot fires started by large fires, however, may start a long distance from the main fire. Any time there are several fires in an area, caused by numerous spot fires or lightning strikes or any other source, they can influence one another and even merge into a large, severe "firestorm."



Figure 1. Matchstick forest

Evaluation

1. Use a sketch to show how slope affects fire spread.
2. If you double the number of trees in a forest, what happens to the fire danger?
3. How does the steepness of a hillside affect a fire's spread?
4. How well do fires burn downhill?
5. How well does slope affect fire spread? Use the fire triangle to explain.

Extensions

1. Learn about wildland fires on a national scale by consulting the U.S. "National Fire Occurrence Maps" on the Internet at www.fs.fed.us/f1re/fuelman
2. What's going on right now in the firefighting business? To find out, visit the National Interagency Fire Center's Internet site: www.nifc.gov